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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/914,994	09/05/2001	Mitsuaki Echigo	388-011500	7881

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EXAMINER	
NGUYEN, NGOC YEN M	

ART UNIT	PAPER NUMBER
1754	

DATE MAILED: 05/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/914,994	ECHIGO ET AL.	
	Examiner	Art Unit	
	Ngoc-Yen M. Nguyen	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoyama (6,290,913).

Aoyama '913 discloses an apparatus for reducing the concentration of carbon monoxide included in a carbon monoxide-containing hydrogen-rich gas and also to a method of the same (note column 1, lines 7-10). As shown in Figure 22, the fuel-system 10G has a methanization unit 95 arranged down the CO selective oxidizing unit 34. The methanization unit 94 is filled with alumina pellets having a methanization catalyst, for example, a ruthenium catalyst, supported thereon. In the fuel-cells system 10G, the reformed gas discharged from the CO selective oxidizing unit 34 is subjected to the methanization reaction of carbon monoxide in the methanization unit 94, before being supplied as the gaseous fuel to the fuel cells 20 (note column 32, lines 22-34). Aoyama '913 further discloses that another possible structure may carry out the methanization reaction of carbon monoxide simultaneously with the selective oxidation reaction of carbon monoxide. Figure 26 shows structure of CO selective oxidizing unit 34H which is filled with alumina pellets having a CO selective oxidizing catalyst, for example, the platinum catalyst, supported thereon as well as the alumina pellets having

the methanization catalyst, for example, the ruthenium catalyst, supported thereon (note column 35, lines 4-19). Aoyama '913 teaches that one catalyst, such as ruthenium catalyst, has both the activities for selective oxidation of carbon monoxide and methanization of carbon monoxide can be used (note column 36, lines 27-54).

Aoyama '913 teaches that oxidizing gas containing oxygen is introduced into the selective oxidation reaction unit for oxidizing carbon monoxide (note column 4, lines 26-36). Even though Aoyama '913 does not specifically disclose the amount of oxidizing gas used, however, it would have been obvious to one skilled in the art to optimize this limitation to obtain the best result without having problem with the reverse shift reaction (note the discussion of the reverse shift reaction in column 3, lines 22-51).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the process of Aoyama '913 to remove CO from any hydrogen-rich gas such as gaseous fuel through the reforming reaction of a hydrocarbon as mentioned in column 1, lines 51-64.

Aoyama '913 further discloses that in the actual methanization unit, the methanization reaction of carbon dioxide expressed by Equation (10) proceeds, in addition to the methanization reaction of carbon monoxide:

$$CO_2 + 4\ H_2 \rightarrow CH_4 + 2\ H_2O \quad (10)$$

The activity for the methanization of carbon dioxide also increases with a rise in temperature of the catalyst. These methanization reactions consume hydrogen in the reformed gas simultaneously with production of methane. In order to prevent a decrease in hydrogen partial pressure of the gaseous fuel lead to the fuel cells, it is

desirable to set the temperature of the methanization catalyst as low as possible in a specific range that enables sufficient methanization of carbon monoxide (note column 33, lines 10-31). This fairly suggests that carbon dioxide is present in the hydrogen-rich gas and the methanization of carbon dioxide is not preferred. It would have been obvious to one of ordinary skill in the art to optimize the condition in the methanization step in Aoyama '913 to avoid the methanization of carbon dioxide.

The difference is Aoyama '913 does not disclose that the methanization unit can be put before the selective oxidation reaction unit.

As stated above, Aoyama '913 fairly teaches that the methanization and the oxidation of the carbon monoxide can be carried out simultaneously, i.e., one reaction does not interfere with the other reaction. The reason why Aoyama '913 prefers to carry out the selective oxidation reaction first before the methanization reaction is because in the methanization reaction, hydrogen is consumed (note column 36, lines 16-21).

Thus, when one of ordinary skill in the art is not concerned about the hydrogen lost in the hydrogen-rich gas, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to carry out the methanization reaction first before the selective oxidation reaction in the process as disclosed in Aoyama '913 because as stated above, these reactions can be independently carried out.

Applicant's arguments filed February 11, 2004 have been fully considered but they are not persuasive.

Applicants argue that Aoyama does not teach or suggest a system or method having a methanization step prior to a second step of oxidation for removing carbon dioxide from a hydrogen-containing gas.

As stated in the above rejection, Aoyama teaches that the oxidation step is carried out first in order to limit the amount of hydrogen consumed by the methanization reaction (note column 36, lines 15-21). It would have been obvious to one skilled in the art to carry out the two steps in any order since they are independent from each other.

Applicants argue that the claimed invention can effectively remove CO from a hydrogen-rich gas with minimum hydrogen consumption.

The above argument and the analysis as set forth in Applicants' argument have been fully considered, however, they are not persuasive because they are considered as mere attorney's arguments and given little weight. There is no side-by-side example to show that the process of Aoyama would consume more hydrogen, especially when Aoyama specifically teaches that the reason the oxidation step is carried out before the methanization step is to minimize the hydrogen consumption. Also, there is clear evidence that all remained oxygen, beside the oxygen consumed in the oxidation of CO, would react with hydrogen to form oxygen.

Applicants argue about the thermal energy in the process.

Applicants' claims do not have requirement regarding the thermal energy.

Applicants further argue that Aoyama's process can be useful or appropriate in a system where the energy utilization ratio can be relatively low, while the claimed invention can be readily used in systems such as a stationary system.

Applicants' claims do not require that the claimed system be a stationary system. Applicants' claims are broad enough to include system with low energy utilization ratio.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen M. Nguyen whose telephone number is (571) 272-1356. The examiner can normally be reached on Part time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Ngoc-Yen M. Nguyen
Primary Examiner
Art Unit 1754

Nmn
September 28, 2003